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DESCRIPTION

SYSTEM TO FORM A LAYERING OF ELECTRONICALLY-INTERACTIVE MATERIAL

The object of this patent is a system for the formation of a layering of electronically-interactive material, according to the characteristics of main claim.

Technical Field

By the term electronically-interactive material, we mean any kind of material which is capable of electronically interacting both in an active sense, such as through conductivity, or in a negative sense, such as through insulation, and does not exclude other parameters such as the typical on/off function which characterises micro-processors.

The invention is used preferably, but not exclusively, for the formation of a layering of electronically-interactive material, such as in: the manufacture of electronic circuit boards; the creation of screens with a layer of electronically-interactive material to project images from a flat screen to create displays, which may also be flexible, directly incorporating a computerised system which does not exclude the function of a microprocessor with both organic and non-organic material, including the function of intelligence which may or may not be artificial, similar to cerebral functions~~; and also~~ visualisation or non-visualisation with different grades of variable luminosity materials by means of electronically induced phenomena which cover the entire range of the spectrum.

Background Art

According to the current state of the technology, the

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formation of a layering, either composed of a single layer or a number of layers, is carried out by either mechanical, chemical or photo-chemical methods. The techniques of layering with mechanical systems are slow and not very suitable for the miniaturisation and precision which modern electronic techniques need to acquire.

For example, in order to create electronic circuit boards, which is one of the main, although not exclusive, uses of this invention, either photographic or photo-engraving techniques are used, and which are far superior to mechanical systems.

In spite of this, modern technology requires techniques which are more rapid and efficient, and which also have miniaturisation and precision capacities superior to those achieved up until now, if possible.

It is well known that, even with photo-engraving techniques, since a photo-sensitive layer has to be engraved, it is not possible to create designs and miniaturised circuits below a certain dimension. That is, it is not possible to go below certain values, which are determined by the minimum distance between two engravings, otherwise it would make the thin layer between them unstable because, if it is too thin, it could be easily detached or ruined. As a general rule, an acceptable value for the ratio of the distance between one engraving and another and the thickness of the layer >1. In fact, if the said ratio were less than 1, the height of the section of the layer would be greater then the width, so the risk of breakage and a resulting short circuit between two adjacent circuits would be high.

DE-19817530A discloses a process and device for the production of a

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thin-multilayer structure.

US-3661304 discloses a pressure impulse apparatus for initiating formation of fluid drops such as ink, in high speed printing, wherein the drops are selectively placed on a paper web, providing a primary liquid supply at a constant pressure and starting means for applying an higher pressure impulse, said starting means including an auxiliary liquid supply.

Aim of the invention

The aim of this invention is to overcome the aforementioned drawbacks and to allow a layer of electronically-interactive material to be rapidly and quickly formed on a surface, which has the maximum precision even with the smallest of designs and which has an extremely low cost.

Explanation of the invention

The problem is overcome according to the characteristics described in the main claim.

Advantages

The advantages obtained with this solution are the following:

- Speed of the process.
- Maximum simplicity.
- Maximum precision.
- Maximum miniaturisation of the structures designed and integrated in the layer.
- Maximum reliability, safety, robustness and duration of the layering.
- Overall reduction of manufacturing costs.
- Respect for the environment with the elimination of all waste materials or pollutants.

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Detailed description of an application

These and other advantages will be shown in the following description and attached drawings of a preferential application of the solution, the details of which are intended to be an example and not a limitation.

Figure 1 is a schematic view of the mechanical solution of the application machine for the formation of a layering of electronically-interactive material on a support sub-layer, such as in the manufacturing of an electronic circuit board.

Figure 2 is a three-dimensional schematic view of the feeding system of the distribution unit for the material used for the formation of the said layering of electronically-interactive material.

Figure 3 is a view of the distribution unit for the material used for the formation of the said layering of electronically-interactive material.

Figure 4 is a schematic front view of the various components of the distribution unit of the system according to the attached claims.

Figure 5 is a three-dimensional schematic view of a machine which embodies the system for the formation of a layering of electronically-interactive material, according to this invention.

Detailed description of the solution illustrated in the drawings

With reference to Figure 1, it is clear from the characteristics in the claims that the formation of the layer of electronically-interactive material is carried out according to an innovative technique compared with previous technology, as follows:

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- A support (a board of plastic material S, for example) is positioned on a mobile bed 2, where the movement of the mobile bed 2 is controlled and programmed by a microprocessor according to a given co-ordinate (Y).
- Above, there is a distribution unit for punctiform jets of the liquefied material to be deposited (3) in order to form the said layer on the said support (S). The distribution unit is programmed to move transversally in a controlled manner by a microprocessor, similar to that of a traditional inkjet printer, with the said distributor having a number of nozzles for the distribution of points the equivalent of pixels, which are able to cover a certain area equal to n x d, where "n" is the number of nozzles which are sprayed in line, and "d" is the distance along the line from one nozzle to another, with a layout, for example, along three lines alternately disposed, 1, 2, 3, for a length of 70mm.
- The forward progress of the underlying support is in steps of 70mm, up to the complete deposit on the surface of the support in question (S).

Figure 2 illustrates the feeding system of the liquefied material (which may be coloured, for example, with conductive powder in suspension in the various containers with a respective electro-induced vibration mixer), which comes from a main container 4 with a cover for loading 40.

This container has two tubes for the liquefied material: one is the feed line 41 by means of a solenoid check valve 410 to a pressure equaliser and regulator 5 which will be described in detail in the successive function, and a return line 71 from a

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recovery and recycling container of the same liquefied material 7, the function of which will be described later.

In this description, the liquefied material means the said material used for the formation of the said layering of electronically-interactive material used to cover the said support or plate of plastic material "S".

From the bottom of the said pressure equaliser and regulator 5, there is a pipe 53 which leads to the bottom of a buffer 6 with an upper air chamber "A". The liquid to be deposited settles in the lower part "L", where there are pipes which take it the nozzle chamber forming the distribution means for point-type sprays (31) which forms the said distributor. The said buffer 6 is suitable, therefore, to contain the said liquefied electronically-interactive material "L", while the upper air chamber "A" acts as a pressure compensator, that is as a damper, being able to increase or reduce according to the emission and/or consumption of the liquefied material and, therefore, increase or reduce the request for material from the intermediate pressure equaliser and regulator container (5).

The said buffer 6 is positioned above and is joined to the distribution means for point-type sprays (31). Also, the said pressure equaliser and regulator 5 may move upwards and downwards parallel to the up and down movement of the said distribution means for point-type sprays (31) and the said buffer 6 on guide carriages 52, and may also be finely regulated in height with respect to the height of the said buffer (6) and the said distribution means for point-type sprays (31) so that it may regulate the pressure either higher or lower for the difference in

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level according to the principle of communicating vessels, with the pressure variation induced by impeding the principle of communicating vessels by means of the presence of the said air chamber "A" in the said buffer 6. In this way, by being able to regulate the pressure either higher or lower according to the programmed value by means of the computer control with a micro-processor, the highest functionality is achieved.

It thus becomes possible to comply to the following conditions according to the program:

i, start distribution at the start of the transversal movement according to "X" with a distribution pressure p1;

ii, vary the said pressure immediately afterwards to the value p2, where p2 < p1, with repetition of the cycle for every transversal movement of distribution-deposit "X";

iii, vary the distribution again to a value of p3, so that p3>p1, for a cleaning operation of the filters where the said material passes, to carry out a maintenance cycle during a non-operational phase, that is, material not being deposited according to "i" or "ii".

According to Figure 4 which schematically illustrates the distribution unit 3, we can see that, at the side of the said distribution means for point-type sprays (31), on one side there is an ultra-violet light transmitter 34 which has the function of polymerising the fluid distributed on the surface of the support material (S), with the liquid being distributed in a form to be polymerised due to the action of ultra-violet rays, and on the opposite side there is an ultra-sonic distance sensor 32 which detects the distance of the underlying support (S) from the depositing bed and transmits the respective data to the processor so

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that, according to the program, it brings it closer, takes it further away or holds it at the same distance.

There is also a television camera 33 to the side, to view the surface of the support zone subject to the deposit in question, both for the fine tuning by means of reference points according to a well known technique, and for checking the correct distribution, depositing, regularity of the covering, etc.

According to Figure 5, we can see a three-dimensional schematic view of a machine which includes all of this equipment in order to use the system according to the characteristics in the claims. The machine has a base 1 which includes the electric and computerised electronic system, with a control computer therefore, and which also has the function of supporting the mobile bed 2 which is movable longitudinally by means of worm screws 20, the rotation of which is controlled by the said computer. The support panel "S", such as an electronic circuit board (in plastic material, for example), on which the layer of electronically-interactive material is to be formed, is placed on the said bed.

A further transversal worm screw 30, the rotation of which is controlled by the said computer, is positioned above the said mobile bed (2). This transversal screw 30 carries the said distribution unit as described 3.

The system for feeding the liquefied material is connected laterally to the said distribution unit (3).

The feeding system is carried out, as already stated, in a controlled way by means of the said three containers 4, 5 and 6 with their respective piping.

At the back, block 340 forms the ultra-violet ray generator

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which feeds the said ultra-violet ray transmitter 34.

Going back to the said main feed chamber 4 and cover 40, it must be made clear that it also has the return pipe 71 which comes from a lateral tank 7 fixed at the side of the mobile bed 2, in order to be covered during the washing phase of the said distribution means for point-type sprays (31) during the non-operational phase of washing the filter with a higher pressure p2.

In this case, the fluid which is fed for the washing phase, which is neither polluted or damaged, is recovered by the said tank from below the nozzles in the said distributor means for point-type sprays (31), and taken by means of the said pipe 71 to the said main container 4.

All three of the containers 4, 5 and 6 have a vibration unit inside to keep the liquid constantly in motion during the feeding operation, in order to keep the suspended substance, which is heavier than the liquid, uniformly distributed (eg. copper powder for the conductivity of the material, pigments for the insulating material, etc.)

The ultra-violet (UV) ray device 34 advantageously works at room temperature and, because it heats up, it is cooled down at the same time according to a controlled temperature by suitable equipment which is part of the machine. In this way, the polymerisation of the deposited material is carried out at room temperature without damaging the material or the support, and without compromising the functionality of the entire depositing unit (3).

The distribution nozzles for the material to be polymerised by means of the distribution unit for point-type sprays (31) are

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advantageously conformed to supply punctiform (pixel-by-pixel) sprays equal to 1 pixel at time in logical sucessione.

There are one or more rows of distribution nozzles. More rows of nozzles or distributors may be foreseen in order to deposit different materials.

An example of different materials could be the following, for example:

- conductive material;
- insulating material;
- covering or protective material.

A further advantage is that the system includes the activation or shut-down of the said ultra-violet ray polymerisation device (34) in a controlled way to make the following possible:

- the direct polymerisation immediately after being deposited, or
- to fix it.

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